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INFLUENCE OF AFTER-BURNING CHAMBER DOME LENGTH ON SECONDARY COMBUSTION FOR SOLID DUCTED ROCKET MOTOR

Abstract

This paper is aimed at the secondary combustion in Solid Ducted Rocket (SDR) after-burning chamber, according to the analysis of ignition and combustion of boron particle and the calculating results of fuel-rich propellant. The 3D reaction flow field in the after-burning chamber of solid ducted rocket motor with binary dual-underside inlet mode was numerically simulated by means of RNG κ-ε turbulence model and one step eddy-dissipation combustion model change trend of combustion efficiency in afterburning chamber was obtained. The after-burning chamber dome lengths are set at about 45mm and 120mm, and the length of the after-burning is 400mm. The influence of after-burning chamber dome length on secondary combustion efficiency and flow field were analyzed with compared the numerical results and the experimental results. The results show that, enough length of after-burning chamber is necessary for the secondary combustion. Increasing of the dome length can the average detention time of boron particles in the head of after-burning chamber significantly, and the ignition of the boron particles can be enhanced. The boron particles resorting time is about 0.3ms in the afterburning chamber dome length is 45mm, and the boron particles resorting time is about 0.55ms in afterburning chamber dome length is 120mm. Therefore, the combustion efficiency of the boron particles in the 120mm chamber dome length is 66.4%, which higher than the one in the 45mm chamber dome length is 64.6%. And the results also show that, the dome length of after-burning chamber has little influence on the combustion efficiency in the same length of the after-burning chamber. The combustion efficiencies are 91.3% and 91.9% when the chamber dome length is set at about 45mm and 120mm correspondingly. The results of the numerical simulation are consistent well with the ground experiments results.